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| 09/990,397      | 11/20/2001  | Jung-Yu Hsieh        | JCLA7289            | 2785             |

7590 10/07/2003  
J.C. Patents, Inc.  
4 Venture, Suite 250  
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EXAMINER

LEWIS, MONICA

| ART UNIT | PAPER NUMBER |
|----------|--------------|
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2822

DATE MAILED: 10/07/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/990,397

Applicant(s)

HSIEH ET AL.

Examiner

Monica Lewis

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

1) ☒ Responsive to communication(s) filed on 30 June 2003.

2a) ☐ This action is FINAL.

2b) ☒ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

4) ☒ Claim(s) 1,2 and 4-13 is/are pending in the application.

4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.

5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.

6) ☒ Claim(s) 1,2 and 4-13 is/are rejected.

7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.

8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

9) ☒ The specification is objected to by the Examiner.

10) ☒ The drawing(s) filed on 20 November 2001 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a) ☒ All b) ☐ Some \* c) ☐ None of:

1. ☒ Certified copies of the priority documents have been received.

2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.

3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_.

4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_.

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other:

### **DETAILED ACTION**

1. This action is in response to the appeal brief filed June 30, 2003.

#### ***Response to Amendment***

2. Applicant's request for reconsideration of the finality of the rejection of the last Office action is persuasive and, therefore, the finality of that action is withdrawn.

#### ***Response to Arguments***

3. Applicant's arguments with respect to claims 1, 2 and 4-13 have been considered but are moot in view of the new ground(s) of rejection.

#### ***Specification***

4. The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. See 37 CFR 1.75(d)(1) and MPEP § 608.01(o). Correction of the following is required: a) "band gap value...equivalent to a band gap of silicon oxide" (See Claim 9).

#### ***Drawings***

5. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the complete structure of claims 6, 7 and 13 must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

***Claim Rejections - 35 USC § 102***

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

7. Claims 7, 10 and 11 are rejected under 35 U.S.C. 102(a) as being anticipated by Bui et al. (U.S. Patent No. 6,163,049).

In regards to claim 7, Bui discloses the following:

- a) a tunneling oxide layer (400) located upon a substrate (For Example: See Figure 2);
- b) a floating gate (500) located upon the tunneling oxide layer (For Example: See Figure 2);
- c) a first oxide layer (601) located upon the floating gate (For Example: See Figure 2);
- d) a high dielectric constant dielectric layer (603) having a dielectric constant greater than 8 located upon the first oxide layer, wherein, together with the oxide layer, a dielectric stacked layer is formed (For Example: See Figure 2 and Column 4 Line 35);
- e) a control gate (700) formed on the high dielectric constant layer (For Example: See Figure 2); and
- f) a source/drain region (200) located within the substrate on the two sides of the floating gate (For Example: See Figure 2).

In regards to claim 10, Bui discloses the following:

- a) the high dielectric constant dielectric layer is a single layer including one material selected from the group consisting of  $Al_2O_3$ ,  $Y_2O_3$ ,  $ZrSi_xO_y$ ,  $HfSi_xO_y$ ,  $La_2O_3$ ,  $ZrO_2$ ,  $HfO_2$ ,  $Ta_2O_5$ ,  $Pr_2O_3$  and  $TiO_2$  (For Example: See Abstract).

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In regards to claim 11, Bui discloses the following:

a) the high dielectric constant dielectric layer is a layer including a mixed material any one selected from the group consisting of  $\text{Al}_2\text{O}_3$ ,  $\text{Y}_2\text{O}_3$ ,  $\text{ZrSi}_x\text{O}_y$ ,  $\text{HfSi}_x\text{O}_y$ ,  $\text{La}_2\text{O}_3$ ,  $\text{ZrO}_2$ ,  $\text{HfO}_2$ ,  $\text{Ta}_2\text{O}_5$ ,  $\text{Pr}_2\text{O}_3$  and  $\text{TiO}_2$  (For Example: See Abstract).

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

9. Claim 13 is rejected under 35 U.S.C. 102(b) as being anticipated by Gill et al. (U.S. Patent No. 5,023,680).

In regards to claim 13, Gill et al. ("Gill") discloses the following:

a) a tunneling oxide layer (9a) located upon a substrate (For Example: See Figure 3c);

b) a floating gate (8) located upon the tunneling oxide layer (For Example: See Figure 3c);

c) an  $\text{Al}_2\text{O}_3$  layer (11) located upon the floating gate (For Example: See Figure 3c);

d) a control gate (10) located upon the  $\text{Al}_2\text{O}_3$  layer (For Example: See Figure 3c);  
and

e) a source/drain region located in the substrate on the two sides of the floating gate (For Example: See Figure 3c).

***Claim Rejections - 35 USC § 103***

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

11. Claims 1, 2, 4 and 5 are rejected under 35 U.S.C. 103(a) as obvious over Joo (U.S. Publication No. 2001/0044187) in view of Bui (U.S. Patent No. 6,163,049) and Park et al. (U.S. Publication No. 2001/0014510).

In regards to claim 1, Joo et al. ("Joo") discloses the following:

- a) a tunneling oxide layer (20) located upon a substrate (10) (For Example: See Figure 2);
- b) a floating gate (30) located upon the tunneling oxide layer (For Example: See Figure 2);
- c) a first oxide layer (32) located upon the floating gate (For Example: See Figure 2);
- d) a high dielectric constant dielectric layer (40) located upon the first oxide layer (For Example: See Figure 2);
- e) a second oxide layer (42), located upon the high dielectric constant dielectric layer, wherein, together with the first oxide layer and the high dielectric constant dielectric layer, a dielectric stacked layer is formed (For Example: See Figure 2); and
- f) a control gate (50) formed on the second oxide layer of the dielectric stacked layer (For Example: See Figure 2).

In regards to claim 1, Joo fails to disclose the following:

- a) a source/drain region located in the substrate on the two sides of the floating gate.

However, Bui discloses a source/drain formed in the substrate (For Example: See Figure 1 and Figure 2). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Joo to include a source/drain in the substrate as disclosed in Bui because that is the structure that flash memory normally comprises (For Example: See Column 1 Lines 5-27).

Additionally, since Joo and Bui are both from the same field of endeavor, the purpose disclosed by Bui would have been recognized in the pertinent art of Joo.

b) dielectric constant of the high dielectric constant layer is greater than 8.

Although, Joo does not specifically disclose that the dielectric constant layer is greater than 8, it is well known that TaON has a dielectric constant over 25 (For Example: See Park et al. Paragraph 8).

In regards to claim 2, Joo fails to disclose the following:

a) a band gap value of the high dielectric constant dielectric layer is less than a band gap value of silicon oxide.

However, Bui discloses a dielectric layer composed of aluminum oxide (603), which has a dielectric constant greater than 10 and a band gap less than silicon oxide (For Example: See Abstract and Column 4 Line 35). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Joo in layer (40) to include an aluminum oxide as disclosed in Bui because it aids in maintaining the capacitance of the ONO film (For Example: See Abstract).

Additionally, since Joo and Bui are both from the same field of endeavor, the purpose disclosed by Bui would have been recognized in the pertinent art of Joo.

Finally, although the prior art does not specifically disclose that the band gap of the high dielectric constant dielectric layer is less than a band gap value of silicon oxide this limitation is seen to be an inherent when the structure recited in the reference is substantially identical to that of the claims, claimed properties or functions presumed to be inherent. In re Best, 562 F.2d 1252, 1254, 195 USPQ 430, 433 (CCPA 1977).

In regards to claim 4, Joo fails to disclose the following:

a) the high dielectric constant dielectric layer is a single layer including one material selected from the group consisting of  $Al_2O_3$ ,  $Y_2O_3$ ,  $ZrSi_xO_y$ ,  $HfSi_xO_y$ ,  $La_2O_3$ ,  $ZrO_2$ ,  $HfO_2$ ,  $Ta_2O_5$ ,  $Pr_2O_3$  and  $TiO_2$ .

However, Bui discloses a dielectric layer composed of aluminum oxide, which has a dielectric constant greater than 10 (For Example: See Abstract and Column 4 Line 35). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Joo to include an aluminum oxide as disclosed in Bui because it aids in maintaining the capacitance of the ONO film (For Example: See Abstract).

Additionally, since Joo and Bui are both from the same field of endeavor, the purpose disclosed by Bui would have been recognized in the pertinent art of Joo.

In regards to claim 5, Joo fails to disclose the following:

a) the high dielectric constant dielectric layer is a layer including a mixed material any one selected from the group consisting of  $Al_2O_3$ ,  $Y_2O_3$ ,  $ZrSi_xO_y$ ,  $HfSi_xO_y$ ,  $La_2O_3$ ,  $ZrO_2$ ,  $HfO_2$ ,  $Ta_2O_5$ ,  $Pr_2O_3$  and  $TiO_2$ .

However, Bui discloses a dielectric layer composed of aluminum oxide, which has a dielectric constant greater than 10 (For Example: See Abstract and Column 4 Line 35). It would have been obvious to one having ordinary skill in the art at the time the invention was made to



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modify the semiconductor device of Joo to include an aluminum oxide as disclosed in Bui because it aids in maintaining the capacitance of the ONO film (For Example: See Abstract).

Additionally, since Joo and Bui are both from the same field of endeavor, the purpose disclosed by Bui would have been recognized in the pertinent art of Joo.

12. Claim 6 is rejected under 35 U.S.C. 103(a) as obvious over Joo (U.S. Publication No. 2001/0044187) in view of Bui (U.S. Patent No. 6,163,049), Park et al. (U.S. Publication No. 2001/0014510) and Choi et al. (U.S. Patent No. 6,340,827)

In regards to claim 6, Joo fails to disclose the following:

a) the material of the high dielectric constant dielectric layer is a stacked layer, each layer of the stacked layer including one selected from the group consisting of  $\text{Al}_2\text{O}_3$ ,  $\text{Y}_2\text{O}_3$ ,  $\text{ZrSi}_x\text{O}_y$ ,  $\text{HfSi}_x\text{O}_y$ ,  $\text{La}_2\text{O}_3$ ,  $\text{ZrO}_2$ ,  $\text{HfO}_2$ ,  $\text{Ta}_2\text{O}_5$ ,  $\text{Pr}_2\text{O}_3$  and  $\text{TiO}_2$ .

However, Choi et al. ("Choi") discloses a dielectric layer composed of a variety of compounds (For Example: See Column 4 Lines 52-67). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Joo to include a dielectric layer composed of a variety of compounds as disclosed in Choi because it aids in preventing the diffusion of oxygen (For Example: See Abstract).

Additionally, since Joo and Bui are both from the same field of endeavor, the purpose disclosed by Bui would have been recognized in the pertinent art of Joo.

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13. Claims 8 and 9 are rejected under 35 U.S.C. 103(a) as obvious over Bui (U.S. Patent No. 6,163,049).

In regards to claim 8, Bui fails to disclose the following:

a) a band gap value of the high dielectric constant dielectric layer is less than a band gap value of silicon oxide.

Bui discloses a dielectric layer composed of aluminum oxide (603), which has a dielectric constant greater than 10 and a band gap less than silicon oxide. However, the prior art does not specifically disclose that the band gap of the high dielectric constant dielectric layer is less than a band gap value of silicon oxide this limitation is seen to be an inherent when the structure recited in the reference is substantially identical to that of the claims, claimed properties or functions presumed to be inherent. In re Best, 562 F.2d 1252, 1254, 195 USPQ 430, 433 (CCPA 1977).

In regards to claim 9, Joo fails to disclose the following:

a) a band gap value of the high dielectric constant dielectric layer is equivalent to a band gap value of silicon oxide.

Bui discloses a dielectric layer composed of aluminum oxide (603), which has a dielectric constant greater than 10 and a band gap less than silicon oxide. However, the prior art does not specifically disclose that the band gap of the high dielectric constant dielectric layer is equivalent to a band gap value of silicon oxide this limitation is seen to be an inherent when the structure recited in the reference is substantially identical to that of the claims, claimed properties or functions presumed to be inherent. In re Best, 562 F.2d 1252, 1254, 195 USPQ 430, 433 (CCPA 1977).

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14. Claim 12 is rejected under 35 U.S.C. 103(a) as obvious over Bui (U.S. Patent No. 6,163,049) in view of Choi et al. (U.S. Patent No. 6,340,827)

In regards to claim 12, Joo fails to disclose the following:

a) the material of the high dielectric constant dielectric layer is a stacked layer, each layer of the stacked layer including one selected from the group consisting of  $\text{Al}_2\text{O}_3$ ,  $\text{Y}_2\text{O}_3$ ,  $\text{ZrSi}_x\text{O}_y$ ,  $\text{HfSi}_x\text{O}_y$ ,  $\text{La}_2\text{O}_3$ ,  $\text{ZrO}_2$ ,  $\text{HfO}_2$ ,  $\text{Ta}_2\text{O}_5$ ,  $\text{Pr}_2\text{O}_3$  and  $\text{TiO}_2$ .

However, Choi et al. ("Choi") discloses a dielectric layer composed of a variety of compounds (For Example: See Column 4 Lines 52-67). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Joo to include a dielectric layer composed of a variety of compounds as disclosed in Choi because it aids in preventing the diffusion of oxygen (For Example: See Abstract).

Additionally, since Joo and Bui are both from the same field of endeavor, the purpose disclosed by Bui would have been recognized in the pertinent art of Joo.

### ***Conclusion***

15. The following prior art made of record and not relied upon is considered pertinent to applicant's disclosure: a) Au et al. (U.S. Patent No. 6,309,927) discloses a flash memory device; b) Hedge et al. (U.S. Patent No. 6,383,873) discloses a structure; and c) Bloome (U.S. Publication No. 2002/0190311) discloses a bandgap design.

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Monica Lewis whose telephone number is 703-305-3743. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on 703-308-4905. The fax phone number for the organization where this application or proceeding is assigned is 703-308-7722 for regular and after final

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communications. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

ML

September 23, 2003



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